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Bilateral superficial radial artery at the wrist associated with a radial origin of a unilateral median artery

The radial artery is classically described at the wrist as passing deep to the tendons of the anatomical snuff-box. Variations in the origin and proximal course of this artery are some of the most common anomalies found in the forearm (15%) (McCormack, 1953), but the finding of a radial artery, or one of its branches, passing superficial to the lateral tendons of the anatomical snuff-box is rare. A persistent median artery has an incidence of 8% (Lippert & Pabst, 1985) but its origin from the radial artery has only rarely been described (Adachi, 1928; Jorge-Barreiro & Valdecasas-Huelin, 1991; Henneberg & George, 1992). The association of a superficial radial artery at the wrist with a median artery arising from it, has not previously been described.

Here we present a case of bilateral superficial radial arteries. On the right there was a Manners-Smith type II anomaly and on the left there was a similar situation for the radial artery except that a median artery was also present. Unusually such a median artery arises distally from the radial artery. The superficial radial artery coursed over the lateral tendons in the anatomical snuff-box before terminating in the deep palmar arch. The median artery passed deep to the flexor retinaculum to close the superficial palmar arch. The pattern for the radial artery is similar to that described among primates and some prosimiae. The anomalies reported were found during routine dissection of 40 upper limbs from human cadavers in the Department of Anatomy, Cambridge University, England. The specimens were right and left forearms from an adult male cadaver aged 93 y. In both arms, the brachial artery divided into the radial and ulnar arteries in the cubital fossa. The course and distribution of the ulnar artery was normal in both forearms. The course of the radial artery as far as the lower third of the forearm was normal. At this level it could be subdivided into 2 branches based on their course and situation: 'superficial' and 'deep'. The 'superficial radial artery' passed dorsally around the superficial aspect of the branchioradialis muscle and superficial to the tendons of the anatomical snuff-box to terminate, in the normal way, by passing between the 2 heads of the 1st dorsal interosseous muscle to complete the deep palmar arch (Fig. 1A, B). The 'deep radial artery', more slender than the 'superficial' one, descended along the normal course of the 'true radial artery' and passed deep to the tendons of the anatomical snuff-box to terminate as the dorsal carpal branch making up the dorsal carpal arch (Fig. 1A, B).

In the right arm a palmar branch arose from the 'deep radial artery' (Fig. 1A); this descended superficial to the flexor retinaculum and anastomosed with the ulnar artery to form the superficial palmar arch.

The superficial radial artery, in the 1st interosseous space, gave off 2 branches, the 1st dorsal metacarpal branch and the princeps pollicis artery (Fig. 1B). In both arms, the princeps

pollicis artery anastomosed with the 1st common digital branch from the superficial palmar arch (Fig. 1B).

In the left forearm, the median artery arose from the radial artery, proximal to the radial artery passing around brachialis. The median artery passed superficial to the median nerve beneath the flexor retinaculum to terminate in the palm by forming a complete superficial palmar arch with the ulnar artery.

The radial artery taking a course superficial to the anatomical snuff box has been described with an incidence of 1% (Quain, 1844; Adachi, 1928; McCormack, 1953; Keen, 1961; Loetzke & Kleineau, 1968; Lippert & Pabst, 1985; Sachs, 1987). Bilateral superficial radial arteries have been described in 3 cases (Sachs, 1987); the other reports which mention the existence of a superficial radial artery do not specify whether findings were unilateral or bilateral.

The course and distribution of the radial artery documented here correspond to the normal course and distribution of the radial artery described amongst primates and some of the prosimiae in which the radial artery divides roughly midway down the forearm into palmar and dorsal portions (Manners-Smith, 1911). The palmar portion continues as the superficial palmar branch the dorsal portion subdivides into 2 branches, superficial and deep. The former extended backwards over the tendons of the anatomical snuff box to pass between the heads of the 1st dorsal interosseous muscle. The latter continued along the course of the radial artery as in normal human anatomical arrangement, passing across the floor of the anatomical snuff box and continuing as a dorsal carpal artery (Manners-Smith, 1911).

Manners-Smith (1911) classified the variants of the radial artery into 2 groups. The type I variant which is more common, involves a single dorsal division and is entirely superficial, as in the case described by Gruber (1870). Type II, which is very rare, involves the dorsal division further dividing into 2 branches, superficial and deep, as described by Quain (1884). Our case falls into the latter group.

The radial artery is considered to be the result of the development of the distal part of the superficial brachial artery (Singer, 1933). Although there are very clear explanations concerning the proximal development of the radial artery, the distal portion has not been well explained. However, our case points to the likelihood that human development is similar to that of the primates, as described by Manners-Smith (1911). We therefore propose, in agreement with Manners-Smith, that the dorsal branch of the superficial brachial artery divides during the embryonic period into 2 terminal branches, superficial and deep. The superficial branch regresses and disappears whereas the deep branch enlarges and takes over the territory of the superficial branch to become the normal adult human radial artery. In this way the complete anomaly may be explained

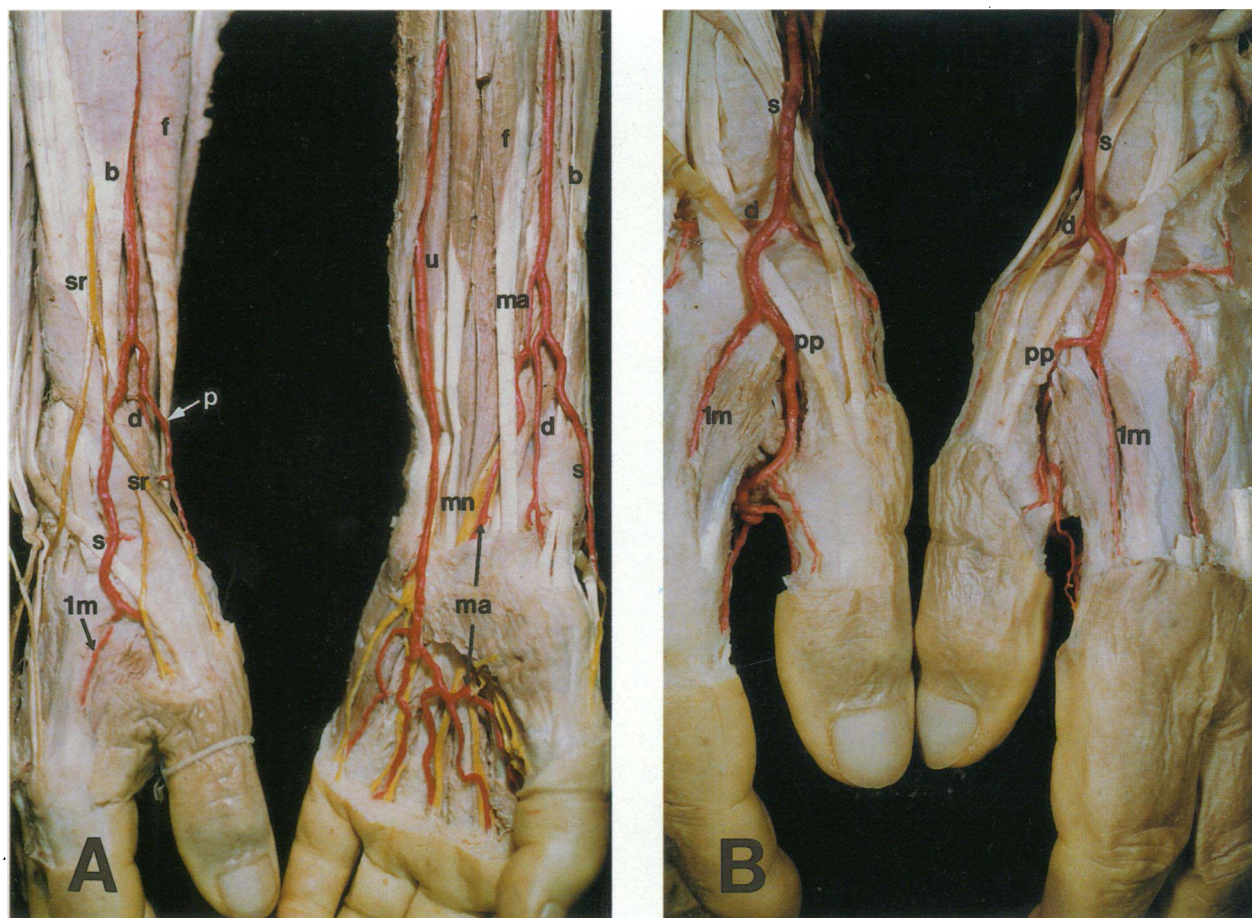


Fig. 1. (A) View of the two forearms with the course of the superficial radial artery and the median artery on the left. (B) Detail of the superficial radial artery in relation to the anatomical snuff box and thumb. b, brachioradialis; d, 'deep radial artery'; f, flexor carpi radialis; 1m, first dorsal metacarpal artery; ma, median artery; mn, median nerve; pp, princeps pollicis artery; p, palmar branch of radial artery; s, 'superficial radial artery'; sr, superficial radial nerve; u, ulnar artery.

by the persistence of the 2 terminal branches of the superficial brachial artery. The 'superficial radial artery' thus does not represent the whole dorsal branch (Grüber, 1870) but only its superficial division, whereas the 'deep radial artery' would represent its deep division.

The superficial brachial artery has 2 anastomoses during its development, one at the level of the elbow with the brachial artery, the other in the forearm with the median artery (Singer, 1933). The origin of the median artery from the radial (left side) could therefore be explained by the persistence of the median-brachial anastomosis.

The presence of these 2 anomalies has been implicated in the occurrence of problems with radial forearm free-flaps (Heden & Gylbert, 1990), compression of the median nerve in the carpal tunnel (Chalmers, 1978) and proximity to intravenous infusion sites (Thomas & Newell, 1995).

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ACKNOWLEDGEMENTS

Mr Bari Logan and the staff of the dissecting room are thanked for their help during the preparation of the specimens, the AVA department for producing the illustrations, and Marc Rodríguez Niedenfürn for the German translations.

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